APPENDIX E Maui County Comments to draft Findings of Fact

Signatories to Sierra Club website response letters received by email

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Signatories to Sierra Club website response letters received by email

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ikitzman@yahoo.com
11/04/02 02:29 PM

To: Charley F Ice/DLNR/StateHiUS@StateHiUS
cc:
Subject: Supporting Designation of the `Iao and Waihe`e Aquifers as Ground Water Management Areas

Chair, Gilbert Coloma-Agaran & Dep. Dir. Linnel Nishioka
HI Commission on Water Resource Mgmt.
1151 Punchbowl St., Room 227
Honolulu, HI 96813

Dear Chair, Gilbert Coloma-Agaran & Dep. Dir. Linnel Nishioka,

Please protect Hawai`i's public trust resources by designating the `Iao and Waihe`e aquifers as ground water management areas. State management is necessary because despite the critical importance of these aquifers as the primary source of domestic water for the Island of Maui, the County's feeble management efforts have led to the marked deterioration of both aquifers. We can no longer afford to sit idly by while water levels plummet and the chloride content of pumped water continues to climb.

The Hawai`i Constitution requires that this Commission "protect, control and regulate the use of Hawai`i's water resources for the benefit of its people." Designation of both aquifers is vital to assure proper management of this system. Please designate both aquifers as ground water management areas and protect our water resources trust for the following reasons:

* Both the `Iao and Waihe`e aquifers satisfy the State Water Code's criteria for designation of a ground water management area.
*When this Commission declined to designate `Iao as a ground water management area back in 1997, Maui County promised that it would take the steps necessary to properly manage this aquifer system and fix its many problems. Maui County has failed to do so and conditions have only gotten worse.
*Although pumping in the `Iao aquifer has decreased from approximately 18 to 16.3 million gallons per day, pumping in the hydrologically related Waihe`e aquifer has increased from 4 to 6 million gallons per day. Moreover, since the Waihe`e wells are clustered at one end of that aquifer, pumping now exceeds Waihe`e's sustainable yield (based on the current configuration of the well fields).
* Many large developments, which will require millions more gallons of water each day, have been proposed in Central and South Maui. Designation is necessary to provide an agency capable of protecting and preserving the water supply for Central and South Maui, with the authority to manage it.

Please act now to preserve Maui's drinking water for present and future generations. I urge you to grant Maui Meadow's petition and assure that `Iao and Waihe`e will receive the management that these invaluable resources deserve. Mahalo for your time and consideration.

Sincerely,

Irene Kitzman
37 Glendale Street
Hamden, Connecticut 06517

Lucienne de Naie
<la.luz@verizon.net>

11/04/2002 08:56 PM

To: Linnel T Nishioka/DLNR/StateHiUS@StateHiUS
cc:
Subject: Comments on Staff Report Proposed Designation of 'Iao aquifer

Aloha- please find attached our comments on the Draft Findings of fact for prposed designation of Iao/Waihe'e aquifers. They are in RTF format- let us know if you have problems opening them. Mahalo,
Lucienne de Naie

-- Iao_staff_comments_re

Linnel T Nishioka
11/08/02 09:12 AM

To: Glenn R Bauer/DLNR/StateHiUS@StateHiUS, Roy Hardy/DLNR/StateHiUS@StateHiUS, Kevin L Gooding/DLNR/StateHiUS@StateHiUS, Charley F Ice/DLNR/StateHiUS@StateHiUS
cc:
Subject: Comments on Staff report- Iao/Waihee aquifer

When Lucienne first sent it to me it was blank so I asked her to resend it. Thanks, Linnel
----- Forwarded by Linnel T Nishioka/DLNR/StateHiUS on 11/08/2002 09:11 AM -----

Lucienne de Naie <la.luz@verizon.net>
11/07/2002 09:00 PM

To: Linnel T Nishioka/DLNR/StateHiUS@StateHiUS
cc:
Subject: Comments on Staff report- Iao/Waihee aquifer

--
To: COMMISSION ON WATER RESOURCE MANAGEMENT
STATE OF HAWAII
P.O. Box 621, Honolulu, HI 96813

Comments Regarding Draft Findings of Fact
on Proposed Designation of 'Iao/Waihe'e Aquifer

Submitted by:

Lucienne de Naie
Maui Tomorrow Ka Wai'ola Project
P.O.Box 429, Makawao, HI 96768
laluz@mauitomorrow.org

Thank you for this opportunity to comment on the Draft Findings of Fact.

Point One: It has been suggested by reliable researchers that sustainable yields for 'Iao aquifer should be adjusted downward. The Draft Findings of Fact appear to dismiss this idea without any rigorous proof that current pumping levels are sustainable. To our knowledge, there is no conclusive data based upon a reliable model which indicates that sustainable yields set for either aquifer are accurate or reliable.

"The estimates of sustainable yield is not meant to be an exact number which can be used in final planning documents....The estimate should not be equatable to developable groundwater. In many regions, taking advantage of a high estimate would not be economically feasible." - George A. L. Yuen & Associates, Inc. State of Hawaii Water Resources Protection Plan, June, 1990.

As the WRPP indicates, sustainable yields are meant to be guidelines and as such it should be the responsibility of water management agencies to be observant of conditions which would indicate that sustainable use was being overestimated and revise figures accordingly.

It would seem that chloride impacts only appear over the long term, since the oldest 'Iao wells 25 to 30 years old) have been the first to show these impacts. It is not prudent to conclude that the newer wells will not develop the same impacts over a longer period of time if the present levels and configuration of pumping does not

Many reputable scientists believe that underground pumping manifests impacts over a long time line, and the most prudent management strategy for underground resources would be to err on the side of caution, and adjust estimates of sustainable yield downward based on impacts noted at the longest use sites.

Point Two: CWRM analyses of future anticipated demand from 'Iao/Waihe'e aquifers may not be based on the true potential of planned and approved projects which would be serviced by the aquifer system.

Section 174C-44 (1) of the State Water Code notes that designation shall be considered when "an increase in water use or authorized planned use may cause the maximum rate of withdrawal to reach ninety percent of the sustainable yields.." The Findings of Fact concludes that a deficit of 1.2 mgd could result from future demands under current community plans and approvals if additional sources outside of 'Iao/Waihe'e do not materialize.

CWRM staff noted that proposed usage in south Maui (such as Wailea 670 - 1,500 luxury units, and Makena Resort - 1,200+ luxury units) as well as a thousand acre expansion of the Maui Lani project in central Maui would all contribute to a demand estimated at "at least 29.2 mgd" over the long term. (This includes the .41 mgd demand from water meters issued to unbuilt projects in central Maui or Kihei districts.) Then the report concluded that since the combined sustainable yield of the 'Iao and Waihe'e aquifers was 28mgd (20mgd 'Iao + 8mgd Waihe'e) a deficit of 1.2 mgd could be possible. For a number of reasons, this does not seem to be an accurate means of assessing real demands and real impacts on the aquifer.

1. Since the State Water Code and Maui County water regulations set a maximum level of 90% of sustainable yield (25.2 mgd) as desirable for long term pumpage, it would be more accurate to say that a potential deficit of 4mgd was possible.

2. Present configuration of Waihe'e aquifer wells do not permit the theoretical sustainable yield of 8mgd to be withdrawn.It was noted in the recent SEIS for the East Maui Water Development Plan (section 12.1.3, page 66) by Mink & Yuen stated that with present configurations of wells in Waihe'e aquifer, the sustainable yield should no more than 4 mgd even after the 3 additional proposed wells in that aquifer (Kanoa 2 & 3 and Maluhia) go on line. This would revise the combined sustainable withdrawal figure (90% of sustainable yield) down to 21.6 mgd. This leaves a deficit of 7.6mgd.

3. In Table 11 covering water demand, CWRM staff appear to have consulted with MDWS staff and reviews in the 1990 Maui County WUDP, not the County Planning Department to assemble their estimates of projected demand. It would be recommended to CWRM staff to consult also with the County Planning office, since there have been past discrepancies in how the two entities view demand estimates. For example, thousands of acres of land serviced by the 'Iao Aquifer are in the process of being sold, subdivided, and converted from agricultural use. This includes 2,400 acres of C. Brewer lands, and more than 600 acres of A&B lands in Ma'alaea, designated as an Urban Project District in the Kihei/ Makena plan as well as a proposed "theme park" in Kihei. The Wailuku/Kahului Community Plan recently redesiginated 177 acres from ag to light industrial including sites for a new hotel and retail outlets.

Ironically, even the 1.2 mgd deficit projected by CWRM staff, was debated by some Maui Council members during the presentation to the

Council's Public Works Committee on October 16 and 19, 2002. One Council member inferred that since several large projects (Wailea 670 and Makena Resort), which have a demand of several million gallons a day each, had not received final zoning approval from the County Council, they somehow should be excluded from projected demand planning. CWRM staff indicated that the commission planning was based on community plan designation since the Commission looked at demand over a 20-year horizon.

For the record it should be noted that both of these projects, although extremely controversial, ahve received approval from the Maui County Planning Commission. A third large development proposed for the south Maui area (800 homes) has recently been revived as well, on land that is designated for urban development in the Kihei/Makena Community Plan.

In the past, it was noted by citizen observers that inaccurate projections of water demand coupled with unrealistic expectations of additional water resources lead to over pumping of 'Iao aquifer in the mid 1980's and again in the mid 1990's. Even the projected water demand deficit of 7.6mgd could prove to be too conservative.

4. In the Draft Findings of Fact (section 3.6.1) CWRM staff concluded that much of the projected water demand from 'Iao/Waihe'e may not realistically needed until 2020. The same general argument was advanced by County officials in the mid-1980's when CWRM staff first proposed designation of 'Iao. This has usually resulted in the CWRM concluding that proposed and existing wells in'Iao have plenty of capacity to meet projected demands as stated by MDWS. The County convinced the Commission that the many large projects on the planning boards would be gradually phased over 15+ years.

Based on this shortsighted information the Commission was able to conclude that the 'Iao aquifer would have sufficient capacity in place through the proposed new Waihe'e wells to meet this new demand. The resort/housing boom hit in 1989 - 1990. The demand was there, but the increased supply wasn't. By the early-1990's 'Iao was being seriously over pumped and another call for designation was made by CWRM staff. This occurred in part because of inaccurate information on both supply and demand being accepted by both Maui County and CWRM staff.
In 1995 and '96 pumping reached 22+ mgd, triggering yet another call for designation by CWRM staff. This repeated history of unrealistic views of supply and demand needs to be replaced by genuine for sustainable management strategies based on unbiased information.

Future Water Sources:

MDWS is counting on 9.8 mgd from eight new wells and a new pipeline in the Ha'iku area. A recent SEIS issued for this project generated considerable comment from both experts and community residents. The majority of these comments found the SEIS to contain numerous inaccuracies regarding interconnectedness of water sources in the area, impacts on near-shore water and marine life, and projected costs versus costs of other potential water resources for the central Maui system. A legal appeal is assured, and any estimates based on availability of Ha'iku water within the next five years may prove extremely unrealistic. It is for this reason that citizens from south Maui have personally petitioned the Commission to consider initiating the designation process and give in-depth professional oversight to the complicated demands and management of Maui's premiere water source - Iao/Waihe'e aquifer.

Point Three: Enforcement of the County's 'Iao Water Management Rule has been avoided by selective presentation of data on existing conditions in the 'Iao/Waihe'e aquifer.

MDWS staff testified during the October 16 and 19 County Council hearing, that the County's 'Iao Water Management rule (section 16-9 of the DWS rules) has never been triggered. This rule identifies management actions the County would take once certain pumpage and chloride limits have been exceeded in the 'Iao aquifer. A number of citizens who have tracked water issues over the past decade feel that the rule has not been enforced is due to manipulation of data to avoid a situation that would mandate such oversight. What this means is that conditions within the 'Iao aquifer continue to bear the stresses of over pumping, yet the data in reports do not indicate any problem which could be easily recognized and proven. Since the water department is semiautonomous, there is no further review of such conditions, and it is unlikely CWMR staff would step in without the authority granted in designated a water management area.

Point Four: Even by the recommendations of MDWS's own experts - Mink & Yuen - DWS is over pumping Waihe'e, with wells too close together, and without adequate information about 'Iao-Waihe'e interconnectedness.

CRWM staff continue to view the current configuration of wells in Waihe'e aquifer as if they actually are well spaced enough to allow a sustainable yield of 8 mgd. Testimony was given to the Maui County Council Public Works committee on October 16 quoting from the MDWS East Maui Water Plan SEIS. In that document, Mink & Yuen stated that with present configurations of wells in Waihe'e aquifer, the sustainable yield should no more than 4 mgd. MDWS wells have been pumping between five and six mgd from Waihe'e aquifer over the past two years. Since these well fields are only five years old, any effects of this regime are likely to show up over a much longer term. However, the Maui County DWS dismisses all concerns and plans new wells virtually in the same sector where existing ones are operating. It is important that accurate information be obtained over the next five years regarding the interconnectedness of Waihe'e/Iao aquifers and the effects of such large-scale pumping within an aquifer where withdrawal sites are not optimized. Designation of a water management area would undoubtedly assure better scrutiny over development of future water sources in Waihe'e and their management. Since pumping in the Waihe'e aquifer involves wells with a short history, studies should be done to see if a sustainable yield of 8 mgd is possible.

Point number 9 of the Draft Findings of Fact indicates that although basal levels in both Waihe'e and Iao have been decreasing, they have stabilized since the year 2000. Once again, it would seem prudent not to draw a long-term conclusion from this apparent stabilization. It may take an additional five to ten years of current pumping rates before a dramatic impact would be visible. But the results could then appear suddenly. Sustainable management strategies should regard this apparent stabilization as a condition warranting further research and verification since only one reliable test well exists in the 'Iao area.

Point Five: MDWS wells have consistently pumped the 'Iao aquifer at rates in excess of 90% of the current sustainable yield (18mgd) for most of the past 12 years. Additional reported users in the aquifer system have added .5 to 1 mgd of additional use during that time. Non-reporting users (HC&S and C. Brewer/Wailuku Agribusiness) have 5 tunnels in 'Iao that could potentially draw millions of gallons a

day. All of these tunnels are located under 1,500 ft elevation. Two of the five are under 500 ft elevation in the urban area of Wailuku. They would not appear to be tapping "high elevation impounded dike water." It would seem sensible to require usage figures and count these tunnels as part of aquifer use.

Point 4 of the Draft Findings of Fact, stated that verified small individual users within the two aquifers constitute less than half a percent of total pumpage. Based on a pumpage of 16 mgd from Iao and five mgd from Waihe'e, this would indicated that 1.1 mgd was used by other sources within the system. This figure is dismissed as being "less than half a percent." and therefore negligible. It would be more accurate to note that the realistic acceptable pumping level of the 'Iao/Waihee aquifer should be based on 90% of 24 mgd sustainable yield (21.6 mgd.) Current usage of MDWS wells is already between 21 and 22mgd. Private usage of another 1mgd would boost the total withdrawals over 90% level.

Historically MDWS wells in 'Iao aquifer have pumped in excess of 18mgd as a yearly average (equivalent to 90% of sustainable yield) from 1991 (18.73mgd) through 1997 (19.10 mgd). Additional pumpage from other users during that period was likely at least .5mgd, boosting totals even higher over the recommended 90%. MDWS pumpage. In 1998 (17.90mgd) through 2001(17.5mgd) MDWS were slightly below the 18mgd threshold, but the number of other users in the aquifer (mostly county parks and public facilities) grew during that time. Realistically, 'Iao aquifer has been pumped at or above 18mgd since 1991. It would not seem in the interests of sound management to overlook this fact or obscure it through use of percentages that do not easily translate to recognizable conclusions.

The CWRM staff has noted that sources which tap dike water within the system were not "counted" against the sustainable yield. However, as noted above, there are 5 tunnels with confirmed use in the 'Iao aquifer and two within the Waihe'e aquifer. Several tunnels in 'Iao are at lower elevations than MDWS wells and it would seem likely they draw from the aquifer.USGS reports indicate that very little is known about how much actual rainfall eventually charges the aquifer or ends up impounded by dikes. Given this lack of reliable information, it seems hasty to assume that water withdrawn from any of seven tunnels under the jurisdiction of C. Brewer or HC&S would have no impact on the aquifer system over the long term. When CWRM records were checked in April, 2002, C. Brewer did not give any usage figures for their tunnels, nor did HC&S. With all due respect to the expertise of CWRM staff, it would seem wise, given the lack of accurate data, to seek and note all withdrawals within the aquifer until there is substantial proof that they are not all interconnected in a long term recharge system.

Thank you for considering these comments in your preparation of the final Findings of Fact on the proposed designation of the 'Iao and Waihe'e aquifer.

Lucienne de Naie
Maui Tomorrow, Kawaiola Project
Project Coordinator

COUNTY COUNCIL
COUNTY OF MAUI
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

November 4, 2002

Ms. Linnel T. Nishioka, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Nishioka:

SUBJECT: **PROPOSED DESIGNATION OF THE IAO AND WAIHEE AQUIFERS**

The Council is in receipt of a correspondence dated September 23, 2002 relating to a request to review and comment on a document entitled "IAO AND WAIHEE AQUIFER SYSTEMS STATE AQUIFER CODES 60102 AND 60103 GROUND-WATER MANAGEMENT AREA DESIGNATION FINDINGS OF FACT" (FOF).

At its meeting of November 1, 2002, the Council voted to take no position, at this time, on the designation of the Iao and Waihee aquifers, and requested instead that comments relative to the draft FOF be submitted to the CWRM.

I concur with the comments recently submitted by the Acting Council Chair on behalf of the Council, and wish to add that my position on designation remains the same as offered in previous oral testimonies to the Commission. Please accept the following comments offered in my capacity as an individual Councilmember.

With input from constituents who have experienced the effects of designation on the island of Molokai, it is my opinion that designation of the Iao Aquifer would have similar support here on Maui. It may assist us in gathering data that we presently have no authority to mandate and thus would have positive impacts on our ability to plan for the future and to compile baseline statistics.

Although the issue of control over the Board of Water Supply is pending before the electorate as a Charter Amendment and will determine whether or not

the Board may become more autonomous or fall under the jurisdiction of the Mayor, it is still important to know that we have the proper controls in place which will result in meaningful change in the way we manage our resources. It is for this reason that no matter what the outcome may be on the charter amendment, I do not believe that designation will significantly impair the County's operations and may actually enhance the ability of the Board to discharge it's duties to the public in regard to water use and planning.

Thank you for your consideration and the opportunity to comment. Should you have any questions, please contact me at 270-5504.

Sincerely,

JO ANNE JOHNSON
Councilmember
Maui County Council

Reg-
Glenn-
Kevin-
Charley

LIFE OF THE LAND

Ua Mau Ke Ea O Ka `Aina I Ka Pono

Hawai`i's Own Environmental & Community Action Group
Protecting Our Fragile Natural and Cultural Resources
Through Research, Education, Advocacy, & Litigation

November 2, 2001

Gil Coloma-Agaran, Chair
Ms. Linnell Nishioka
Commission on Water Resource Management
1151 Punchbowl Street
Honolulu, Hawai`i 96813

By Fax: 587-0219

Support designation of `Iao and Waihe`e Aquifers as Groundwater Management Areas

Aloha Chair Coloma-Agaran and Ms. Nishioka!

Life of the Land strongly supports the designation of these two critical aquifers as groundwater management areas. More than twenty years ago, Life of the Land advocated for state management of the Pearl Harbor aquifer, which serves the drinking water needs for a large portion of O`ahu's people. Like Pearl Harbor, `Iao aquifer holds the fresh water needed by more than half of Maui's population.

For decades environmentalists and residents have been concerned with the overpumping of `Iao aquifer and the "bottomless pit" mentality that seemed to pervade Maui county. In an island environment all our resources are precious. On Maui we have seen lo`i kalo starved for water and streams drying up, while fancy resort hotels and big business seem to have an abundance of water for their needs. Something is obviously wrong.

American Friends Service Committee
Hawai'i Area Program Office
2426 O'ahu Avenue
Honolulu, Hawai'i 96822
Phone: (808) 988-6266
Fax: (808) 988-4876
Email: afschawaii@afsc.org

Gil Coloma-Agaran
Commission on Water Resources Management
P.O. Box 621
Honolulu, HI 96809

November 1, 2002

Re: 'Iao and Waihe'e aquifers

Mr. Coloma-Agaran,

My name is Mohala Aiu. I am the Hawai'i Area Program Coordinator for The American Friends Service Committee (AFSC), a Quaker-based non-profit that works on peace and justice issues. I work in the area of hawaiian rights and economic justice. I would like to present testimony on behalf of AFSC in support of the designation of 'Iao and Waihe'e aquifers as ground water management areas.

The 'Iao and Waihe'e aquifers are the primary source of water for domestic use in Maui County. The feeble management by the County of Maui of vital water resources has lead to dangerous levels of chloride in fresh water lenses, the result of over pumping supported by overestimation of sustainable yields. Maui County has continued to issue water meters for new development and has facilitated in the development of new wells which would additionally tax these aquifers. The present situation of the water table on Maui cannot continue for the safety of the residents and the continued viability of the island.

We support designation of the 'Iao and Waihe'e aquifers as ground water management areas. Thank you for your time.

Sincerely,

Mohala P. Aiu
Hawai'i Area
Program Coordinator

COUNTY COUNCIL
COUNTY OF MAUI
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

November 1, 2002

Ms. Linnel T. Nishioka, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Nishioka:

SUBJECT: **PROPOSED DESIGNATION OF THE IAO AND WAIHEE AQUIFERS (PWT-13)**

The Council is in receipt of a correspondence dated September 23, 2002 relating to a request to review and comment on a document entitled "IAO AND WAIHEE AQUIFER SYSTEMS STATE AQUIFER CODES 60102 AND 60103 GROUND-WATER MANAGEMENT AREA DESIGNATION FINDINGS OF FACT" (FOF).

The matter was extensively reviewed at the Council's Public Works and Transportation Committee meetings of October 16, 2002 and October 18, 2002. During its discussion, the Committee reviewed the document in depth and asked questions of representatives of the Commission on Water Resource Management (CWRM) and the United States Geological Survey (USGS).

At its meeting of November 1, 2002, the Council voted to take no position, at this time, on the designation of the Iao and Waihee aquifers, and requested instead that comments relative to the draft FOF be submitted to the CWRM.

On behalf of the Maui County Council, I am submitting the following comments for your consideration:

1. In 1996, the CWRM set milestones for the Department of Water Supply (DWS) to meet as it considered designation of the Iao Aquifer. The CWRM may wish to consider the following requirements to be met by the DWS prior to designation:

a) implement targeted and systematic water conservation programs;
b) reduce pumping;
c) reduce chloride concentrations and enforcement of the Iao Water Management Rule (IWMR);
d) revise the IWMR to increase its effectiveness by setting triggers for caution, alert and critical low ground water conditions at 90, 95 and 100 percent, and clarify the goal of the rule to reduce the 12-month moving average below 90 percent of its sustainable yield;
e) expedite completion of the Central Maui Water Use and Development Plan;
f) obtain a commitment to focus resources and develop a final agreement to work jointly with USGS on the creation of a dynamic numerical model of the Iao and Waihee aquifer systems;
g) develop instream flow standards and stream restoration plans for Waikapu, Wailuku, Waiehu, and Waihee streams;
h) establish optimal spacing of DWS wells in Iao and Waihee aquifers; and
i) increase water resources for Central Maui to assist with aquifer recharge programs, stream restoration and domestic water supply.

2. Within the Executive Summary subsection entitled "Major Findings", items 2 and 6 indicate that the sustainable yield of the Waihee aquifer is 8 million gallons per day (mgd) with water withdrawal statistics at 5 mgd. However, the Final Environmental Impact Statement for the East Maui Water Development Plan states that: "No more than four mgd can be expected from the North Waihee project, although the entire North Waihee aquifer system, which extends from Waihee Valley to Kahakuloa Valley, has a sustainable yield of eight mgd." These statistics should be resolved to be consistent with accurate withdrawal figures. Current Waihee pumpage appears to be over 1 mgd *above* the recommended yield from the existing wells in the Waihee aquifer. Please review these documents so that the data provided in the FOF can be justified to prevent any inconsistencies with accurate withdrawal figures.

3. Page viii of the Executive Summary notes that: "The current CWRM established sustainable yield of the system is 20 million gallons per day (mgd) and is deemed reasonable at this time."

However, the District Chief of the USGS stated, in correspondence dated October 20, 2001, to the Board of Water Supply that: "Under the current distribution of pumpage the regulatory level of 20 million gallons per day for the Iao aquifer does not appear to be sustainable." (See attached.) This data also appears to be contradictory; therefore, the sustainable yield should be confirmed.

4. Section 3.6.2, Growth of CMSA Supply, page 67 of the FOF, states that the Kihei-Makena Community Plan identifies the County water demand standard for this area at 600 gal/day per single-family residence. However, the Director of DWS stated to the Council that the water average use for a single-family unit is 2,000 gal/day in Makena and 1,200-1,500 gal/day in Kihei. This is significantly more than 600 gal/day. These numbers must be clarified.

5. Section 3.8.1 Iao Aquifer System Designation Criteria noted in Criterion 5 that "...chloride limits have been exceeded under the DWS Iao Water Management Rule and enforcement actions have not been implemented." The CWRM should require the Board of Water Supply to enforce the rule and follow other conservation programs outlined in the rule in order to protect the aquifer.

6. According to comments received from the Director of Water Supply, if the Iao and Waihee aquifers are designated, the use of the Wailuku Shaft may be in jeopardy. Therefore, the CWRM and the DWS must ascertain the status of the rights of the DWS to the withdrawal of water from the Wailuku Shaft.

7. The DWS and the USGS are considering a joint 4.5-year project to develop a dynamic numerical model of Iao and Waihee aquifer systems and other aquifers in Maui County. However, prior to proceeding with this project, the Council noted that resources and technical support from the CWRM must be utilized to obtain up-to-date information on water use and pumpage from private wells. The Council further noted that accuracy of the draft FOF is suspect due to the lack of reporting and data from all water users (including the private water users) of Maui County's aquifer systems. Additionally, even though the CWRM has the authority to mandate reporting statistics, it has failed to request this information and relies on data submitted by the water "user". There appears to be no system of checks and balance to guarantee that the water

withdrawal, as submitted by the "user", is accurate. Cooperation from the CWRM in providing this information is essential.

8. The Council noted that the deadline for submission of comments is November 4, 2002; however, included on the election ballot for the County of Maui are two proposed Charter amendments relating to the operation and administration of the Department and Board of Water Supply. Approval of either amendment will result in a change in the authority of the Department of Water Supply and the Board of Water Supply. As a result, the Council desires to withhold taking a position on the designation until after the November 5, 2002 general election. Accordingly, the Council felt that the CWRM may wish to consider these circumstances prior to reviewing this matter. Therefore, the Council would respectfully request that the CWRM defer action on this proposal until a later date, to allow the Council an opportunity to fully review this issue of designation, in light of the results of the general election. Currently, even though the meeting on this matter is scheduled for November 20, 2002, which is after the general election, the Council's Public Works and Transportation Committee and the Council will be unable to take a formal position on the matter prior to the comment deadline. If the matter is deferred, the Council requests that the meeting be held on Maui.

9. The CWRM's evaluation of impacts of "authorized planned use" of water under Section 174c-44(1) fails to recognize the difference in the County of Maui's planning process. The Council noted that while the draft FOF recognizes "long–range authorized planned use" for calculating future demand on water resource, it fails to consider that the planning process to achieve development is extensive and may impact the project's ability to secure necessary approval.

10. Develop an integrated water system to allow the flexibility of pumping in areas that are not stressed as a result of continual withdrawal. An integrated system will also allow the purveyor of water to have more flexibility with delivery. This system will reduce the burden on over tapped water sources.

11. Pursue development of new water sources to lessen the need to focus on existing sources. Implement innovative funding sources

such as, reimbursement from the County, to help facilitate the creation of new water sources and expedite use of these sources.

12. Emphasize the concept that water belongs to everyone. Water resources must be viewed similar to air, everyone needs it to live and the government must utilize everything in its power to guarantee the availability and delivery of water.

13. Create an enforcement mechanism and guidelines to prevent the contamination of ground-water resources from older wells and equipment that may impact water quality.

On behalf of the Maui County Council, I respectfully request that you consider the above comments during your deliberations of this matter. Furthermore, I wish to extend our appreciation for conducting the hearing on this matter here in Maui. Should you have any questions or require clarification, please contact me at 270-7760 or Legislative Analyst Gary Saldana at 270-7662.

Very truly yours,

DAIN P. KANE, Acting Chair
Maui County Council

pwt:ltr:13blnr05:grs

October 30, 2002

Commission on Water Resource Management
State of Hawaii DLNR
P.O. Box 621
Honolulu HI 96809

RE: In Support of the Petition to designate 'Iao aquifer and Waihe'e aquifer, Maui Island as groundwater management areas.

Aloha,

Designation as a Groundwater Management Area is the vital first step in water management and protection which includes meaningful involvement of the people who will be most directly affected by the decisions made. The required public hearings will encourage discussions about water development, water use priorities, conservation, and the importance of healthy watersheds, and nurture what is required for a healthy society.... open discussion and citizen participation.

Please proceed to designate both the 'Iao and Waihe'e aquifer sectors as Groundwater Management Areas. We understand the CWRM now recognizes the one-to-one relationship of ground to surface water, so that designation of either effectively means more careful protection of both.

We are aware on Molokai perhaps more than elsewhere of the fragile and finite nature of water resources on small islands. We are encouraged that the citizens of Maui Island are also aware of the need for careful and deliberate decision-making. Designation, especially of 'Iao, is long overdue.

Sincerely,

K.Mahealani Davis
P.O. Box 350
Kaunakakai HI 96748

COUNTY COUNCIL
COUNTY OF MAUI
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

October 28, 2002

Ms. Linnel T. Nishioka, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Nishioka:

SUBJECT: **PROPOSED DESIGNATION OF THE IAO AND WAIHEE AQUIFER (PWT-13)**

At its meetings of October 16, 2002 and October 18, 2002, the Maui County Council's Public Works and Transportation Committee reviewed a document entitled "IAO AND WAIHEE AQUIFER SYSTEMS STATE AQUIFER CODES 60102 AND 60103 GROUND-WATER MANAGEMENT AREA DESIGNATION FINDINGS OF FACT" (FOF).

During its discussion, the Committee noted that the deadline for submitting comments on the draft FOF, is November 4, 2002. The Committee also noted that included on the election ballot for the County of Maui are two proposed amendments to the Charter of the County of Maui, which may result in the change of authority for the Department of Water Supply and the Board of Water Supply.

The ballot questions for the Charter amendments, relating to the Department of Water Supply, are as follows:

PROPOSED AMENDMENT NO. 9:

> "Should the Department and Board of Water Supply be restructured to have more control to operate, whereby (A) the Department would have the authority to coordinate private water systems (while respecting existing property rights), and (B) the Department would have the responsibility to prepare water use and development plans for each community plan district and a long-range capital

improvement plan (both of which would be updated every five years); whereby (C) the Board of Water Supply would be restructured so that the Directors of the Department of Planning and Public Works become voting members of the Board and the other seven members would be appointed by the Mayor with approval by the Council for three-year terms (subject to being reappointed once), (D) the Board would be given the power to establish rules and set rates without further review, (E) the Board would be required to evaluate the Director annually, and (F) the Board could hire (using the Department's revenues) independent legal counsel by a two-thirds vote when necessary; and whereby (G) an independent audit would be conducted annually, after which the Council could make recommendations for changes?"

and,

PROPOSED AMENDMENT NO. 9A:

"Should the Department and Board of Water Supply be restructured in a manner whereby (A) the Department would become a regular County agency subject to the Mayor's executive management and the Council's legislative oversight and (B) the Board would be recasted as an advisory body (with the power to recommend budget proposals and rate adjustments), whereby (C) the Mayor would be assigned the power to appoint the Director (with the approval of the Council) and (D) the Mayor and Council would continue to have final approval of rates and regulations; whereby (E) the Department would have the responsibility to survey public and private water resources and (F) prepare and annually update a long-range capital improvement plan (subject to Council approval) and implement such approved plans, and whereby (G) the Council would have the power to issue general obligation bonds and provide appropriations for capital improvements of the water system?"

The Committee decided to defer taking a position on the question of designating Iao and Waihee aquifers until after the November 5, 2002 general election. Furthermore, the Committee suggested that the CWRM withhold taking a position on the designation question until after the County Council has had the opportunity to fully assess the results of the election. Currently, even though the Commission's meeting on this matter is scheduled for November 20, 2002, which is after the general election, the Council's Public Works and Transportation

Committee and the full Council will be unable to take a formal position on the matter prior to the comment deadline and the November 20th meeting date.

As a result, on behalf of the Council's Public Works and Transportation Committee, may I respectfully request that the CWRM defer action on this matter until a later date, to allow the Council an opportunity to fully review the issue of designation in light of the results of the general election. Furthermore, may I request, that the meeting on this matter be conducted here on Maui, should you decide to defer action on this matter.

Thank you for your consideration of these requests. Should you have any questions or require clarification, please contact me at 270-5511 or my Committee staff (Gary Saldana, 270-7662 or Jo-Ann Sato, 270-8006).

Very truly yours,

MICHAEL J. MOLINA, Chair
Public Works and Transportation Committee

pwt:ltr:13blnr04:grs

October 28, 2002

Maui Meadows Homeowners Association
P.O. Box 1935
Kihei, HI 96753

State Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawaii 96809

Attn: Linnel Nishioka
Deputy Director

Subject: Designation of Iao and Waihee Aquifers
Draft Findings of Fact (FOF)

Aloha Linnel,

I am submitting those comments on behalf of the Maui Meadows Homeowners Association on the subject FOF.

EXECUTIVE SUMMARY

We are submitting brief remarks on this chapter, including the major findings. More detailed comments follow.

a) *FOF*

Staff states that the sustainable yields of 20 mgd for Iao and 8 mgd for Waihee Aquifers are deemed reasonable at this time.

Comment

We believe that no evidence has been submitted to support sustainable yields at this level. On the contrary much lower values are considered appropriate.

b) *FOF*

States that the midpoint of the transition zone is currently rising at about 4 feet/year.

Comment

The long term rise in the transition zone is twice the above value. The rise of the transition zone is not necessarily uniform and it is misleading to select a rate increase over a limited term. It will continue over time until the pumpage is decreased significantly.

c) *FOF*

Staff states that localized upconing for the Mokuhau and Waiehu Heights well systems does not represent regional degradation of the aquifer.

Comment

Fig. 18 tells it all. While excess pumpage is occurring and the underlying salt level continues to rise, more salt water intrusion of these and other wells can be expected, which certainly represents degradation of the Iao Aquifer.

d) *FOF*

Long range future demand is expected to be at least 29.2 mgd, so exceeds sustainable yields at Iao (20 mgd) plus Waihee (8 mgd) by 1.2 mgd.

Comment

Accepting the 29.2 mgd demand and the 20 mgd sustainable yield at Iao Aquifer, but allowing just 4 mgd for the 4 wells at Waihee as recommended by consultant John Mink, the deficit increases to 5.2 mgd. It will be even greater if the sustainable yield for the Iao Aquifer is reduced as discussed later.

e) ***FOF***

The Iao Water Management Rule has been adopted by the MDWS, but is not being enforced.

Comment

We concur, there has been no attempt at conservation.

MAJOR FINDINGS

a) ***FOF***

Both Iao and Waihee Aquifers have experienced significant drought conditions since 1998.

Comment

Certainly low level rain gages show drought conditions since 1998. However, we take issue with the adjective "significant." During this period Gage #380 at Puu Kukui shows average rainfall or better until last year. Since as the isohyets show a considerable percentage of the precipitation occurs at the higher level, this must increase the average rainfall over the entire area appreciably. Besides, the records show droughts occurring at 5 to 10 year intervals.

b) ***FOF***

States that water levels have stabilized since 2000.

Comment

Water levels show up and down variations year by year. However, there is a continued decline in levels for both aquifers as shown in the graph in our Exhibit A.

c) FOF

Groundwater Criteria No.s 1 and 4 have been MET for the Iao Aquifer, and No. 1 has been MET for the Waihee Aquifer.

Comment

We concur with the FOF conclusion on groundwater criterion 1 and 4 being MET. In addition, we maintain that the Criterion No. 3 has been MET for both aquifers due to the continued decline of groundwater.

FOF TEXT

3. Proposed Iao and Waihee Aquifer Systems

3.1 Areal Extent

FOF

Discusses the various aquifer systems.

Comment

We concur that:

- Aquifer systems within a sector (such as Iao and Waihee) are hydraulically connected despite their water level differences.
- The water level differences between Iao and Waihee do not mean they are hydrologically independent of each other.

3.4 Iao Aquifer System Hydrology

a) *FOF*

Water levels closely track rainfall patterns, therefore, it appears that rainfall correlates strongly with all observation wells water levels. This shows rainfall having a stronger influence then pumpage on water levels.

Comment

We disagree with the rainfall correlation concept. During the period of 1992 - 1998 the rainfall is approximately uniform at 100% of average and yet well levels declined. On the other hand, pumpage was also relatively constant at between 18 - 20 mgd during this same period. This proves the aquifer is being over-pumped.

The correlation coefficients quoted in the range of 0.3 to 0.4 are low and indicate such correlations should not be attempted.

b) *FOF*

The rate of rise of the transition zone since 1998 is 4.75 feet/year. At this rate the mid-point of the transition zone would encroach on the bottom of Waiehu Heights and Mokuhau wells within 75 or 94 years, respectively.

Comment

It is misleading to assume slowing of the rise of the transition zone for a few years will continue. Over the last ten years the mid-point of the zone has risen at a rate of 8 feet/year. However, in the four year period from 1988 - 1992 the rate of rise was relatively low, then it took off at 10+ feet/year.

It is not possible to predict the future level of the mid-point of the transition zone except that it will increase inexorately unless pumping from the aquifers is reduced. To even contemplate a 75 to 94 year period when the mid-point of the zone could be expected to intercept the bottom of the well fields is foolhardy. These wells already suffer from salt water intrusion due to upconing (Fig. 18) and further increases in the chloride concentrations are to be expected again by upconing, unless pumping from the Iao and Waihee aquifers is reduced.

c) *FOF*

Chloride concentration in the Iao wells are shown in Figs. 19 through 28. Waihee 2, Waiehu Heights 1 and the Mokuhau well field have chloride amounts which have trended up since 1983. Mokuhau 2 was shut down in 1995 due to very high chloride concentrations; Wailuku Shaft 33 was brought on line to alleviate stress on the Mokuhau field.

Comment

- Mokuhau 3 pumps most of the water for this field and recent chloride concentrations are as high as 200 mg/l.
- Waiehu 1 has a chloride concentration of about 175 mg/l. Staff contributes this high salt level to the fact that this well is deep. However, shallower wells in the Mokuhau field also suffer from high salt levels; on the other hand, Shaft 33 is as deep as the Mokuhau wells and the water quality remains good.
- The Waiehu 2 chloride concentration is about 100 mg/l.
- Not explained for the Waihee well field is that the chlorides have decreased to 20 - 40 mg/l since 1997, even though station pumping was not reduced until 2001.
- Chlorides in Shaft 33 are relatively low at 50 - 60 mg/l. However, the

concentration could increase if pumpage from this source continues to rise to compensate for reduction in pumping in other wells to improve water quality.

d) ***FOF***

The sustainable yield of the Iao Aquifer was established by the CWRM in 1990 at 20 mgd, using a one dimensional analytical model (RAM - Robust Analytical Model). However, USGS Report WRI 00 4244 in 2001, points out that predicted water levels from such a RAM will not be accurate and that the sustainable yield so determined will be over estimated. A regional numerical model is required to arrive at a more accurate estimate of the sustainable yield. The USGS will conduct such a study for the MDWS, but it could take several years to complete.

Comment

The method used by the CWRM to establish the amount of sustainable yield for the Iao Aquifer, the RAM, has serious limitations as compared to the USGS numerical modeling method. It does not account for the presence of the caprock confining unit. Nor does RAM account for the spatial distribution of groundwater withdrawals from wells, which is significant because water level declines are greatest in the vicinity of withdrawal wells. Thus, withdrawal of water from the aquifer at the maximum sustainable yield can only be achieved by optimizing location of wells.

The recent USGS Report 00-4244 discusses that water level declines from using RAM can be significantly less than from numerical groundwater flow models. In 1995 and 1996 withdrawals from Iao reached 20 mgd, the value derived from the RAM. However, even before 1996 water levels in the aquifer declined substantially below those predicted by RAM, and continued to decline in 1997. To halt the decline of water level, and to restrict the intrusion of saltwater into the four major well fields in the aquifer, total pumpage from the Iao Aquifer must be reduced well below the sustainable yield of 20 mgd derived from the RAM.

e) ***FOF***

To confirm the 20 mgd sustainable yield, the CWRM staff considers the estimate of recharge for the Iao Aquifer. The original estimate for recharge was 15 mgd, but later estimates are higher, ranging from 29 to about 32 mgd. Still the CWRM insists on maintaining an official recharge estimate of 15 mgd, less than the sustainable yield of 20 mgd. It is stated that studies suggest (emphasis added) that the recharge in the Water Resource Protection Plan is too low and suggest (emphasis added) that the current sustainable yield is appropriate. It goes on to say that current field data suggests (emphasis added) that pumping at the sustainable estimate is not endangering the aquifer but may reduce the utility of the deeper Mokuhau and Waiehu 1 well systems.

Comment

We are at a loss to understand why the CWRM staff does not officially adopt a realistic recharge number for Iao. Also, why it continues to insist on using a sustainable yield of 20 mgd when there is so much evidence that points to a lower value. We are concerned that in a "Fact" report the only justification for adopting recharge and sustainable yield values is that the data suggest they

are reasonable without any substantiation. Surely the decline in water levels, the encroachment of saltwater into several well systems, and the continued rise of the transition zone between the fresh water lens and the underlying saltwater, is evidence that the aquifer is being over-pumped.
The estimate of sustainable yield for the Iao Aquifer at one time was 50 mgd. This was obviously too high and in the 1970's was reduced to 35 mgd. In 1990 the number was established at 20 mgd by CWRM. Discussion coming from recent USGS studies has placed the sustainable yield even as low as 13 - 14 mgd. The studies have been interpreted as showing the sustainable yield as not being greater than 16 mgd which is the amount currently being pumped. In our view, the staff should take a conservative position and reduce its present number at least by 10% from 20 mgd to 18 mgd.

3.5 Waihee Aquifer System Hydrology

a) *FOF*

Waihee River forms the southern boundary of the basal aquifer. Kahakuloa Stream forms the northern boundary. Recharge has been estimated at a low of 12 mgd (1990) to 25.5 mgd (1995). CWRM staff believes that conservative estimates should be used for recharge, i.e. 12 mgd. Staff believes in using conservative estimates of recharge until long term pumping experience is available.

Comment

- As John Mink states, alluvials in Waihee River facilitate connection between the Iao and Waihee Aquifers.
- The initial recharge estimate of 12 mgd for the Waihee Aquifer is 19% of total rainfall and the sustainable yield is 8 mgd, a ratio of 0.66%. By comparison, the initial recharge estimate for the Iao Aquifer is 15 mgd, which is again 19% of the total rainfall, but the estimated sustainable yield is 20 mgd, a ratio of 1.33%, which is comparatively twice as much. The staff is inconsistent for Iao in asserting that the recharge number is too low, when comparing the rainfall ratios.

b) *FOF*

Water levels are very sensitive to rainfall patterns. Like Iao, rainfall correlates strongly with observation well water levels in the Waihee Aquifer.

Comment

Adequate correlation of water level with rainfall or pumpage doesn't exist. It is even less valid than for the Iao Aquifer. In Fig. 36 the water levels in North Waihee from 1988 to 1997, prior to any pumping by MDWS from the North Waihee wells and prior to the recent drought, shows the same pattern of decreasing levels as for the Iao wells. Hence, the statement that the 1996 - 2001 drought explains the decline in water levels is incorrect. The decline of levels in the early years collaborates the connection between the two aquifers. Pumping in one aquifer certainly affects the water levels in the adjacent aquifer.

c) *FOF*

Chloride concentrations for North Waihee wells have remained fairly consistent at 20 mg/l. Concentrations in Kanoa wells are rising, they are currently between 30 mg/l and 40 mg/l.

Comment

These wells are very shallow so as expected the water quality is high.

d) *FOF*

The RAM was used to estimate a sustainable yield of 8 mgd as being reasonable (emphasis added). Limited data suggest that the current pumpage of 5 mgd will not endanger the aquifer.

Comment

- We have no opinion on the 8 mgd value for sustainable yield for the entire Waihee Aquifer. However, we concur with the recommendation of consultant John Mink that the sustainable yield of the present localized well systems in the southern tip of the aquifer is only 4 mgd (not 8 mgd). Hence, pumping at 5 mgd, as as stand alone aquifer will indeed endanger it.
- Since all the evidence points to a strong hydrologic connection between the two aquifers, the combined current pumpage of some 21 mgd is about 88% of the sum of 20 + 4 mgd sustainable yields. If the Iao portion has a sustainable yield of only 16 mgd, the combined pumpage represents 105% of the sum of the sustainable yields. Water level decline data, as shown in our Exhibit A, support the latter assumption of over-pumping of the combined aquifer systems.

3.6 Future Development and Projected Water Use

a) *FOF*

Table 11 shows estimated total projected water requirements including the three major project developments, Maui Lani, Makena Resort and Wailea 670, total 6.736 mgd of the estimated increase in demand of 7.147 mgd. The estimated future total projected use is 29.2, and for a combined sustainable yield of 28 mgd (20 + 8), staff arrives at a deficiency of 1.2 mgd.

Comment

Continuation of two of the major projects assumed in the FOF is in question. However, with an increase in annual demand of 500,000 gpd, and one major project, one arrives at about 7 mgd increase in demand over 10 years, which is the minimum time it would take to bring another major water source on line. According to John Mink pumpage from North Waihee and Kanoa fields, including Kupaa, has maxed out at 4 mgd. To avoid strong interference with the Iao Aquifer system, additional wells in the Waihee aquifer need to be located some distance away from the existing well field to the north of Makamakaole Stream and even as far as the Kahakuloa Aquifer. The proposed East Maui Water Development has an uncertain future due to continuing public opposition and time and cost constraints. Even assuming a sustainable yield of 20 mgd for the Iao Aquifer, together with 4 mgd for the existing well field in the Waihee Aquifer, the total of 24 mgd would result in a deficit of supply of 5.2 mgd to meet the 29.2 mgd demand shown in Table 11.

3.8.1 Criteria for Designation - Iao Aquifer

FOF

Staff lists eight criteria to be considered by the CWRM in determining designation as a groundwater management area.

Staff selects two criterion as having the conditions MET:

Criterion 1, regarding excess withdrawals.

Criterion 4, regarding water quality.

The staff states that water levels have been stable for the past three years despite drought conditions.

Comment

- We concur that Criterion 1 and 4 are MET.
- We also consider that Criterion 3, regarding excessively declining groundwater is MET.

  Water levels have not been stable for the last three years. Our Exhibit A shows that water levels for Test holes A1 and B, and the Waiehu deep monitor well, all continue with their general decline, year to year perturbations not withstanding. Therefore, Criterion 3 is MET. A new deep monitor well in the southern part of the aquifer will not be of great help, since the bulk of withdrawals from the aquifer are from the wells in the northwest.
- We go along with Criterion 5, regarding management of water quality, to be NOT MET. However, this is somewhat shaky since the MDWS has adopted but not to enforced its own Iao Water Management Plan.

3.8.2 Criteria for Waihee Aquifer Designation

FOF

Staff selects one criterion as having the conditions MET, Criterion 1, regarding excess withdrawals.

The staff states that water levels have declined since 1989, but not excessively. Groundwater levels have been stable since 2000.

Comment

- We concur that Criterion 1 is MET.
- We also consider that Criterion 3 is MET.

  The overall decline in groundwater levels since 1989 continues and because of the interconnection of its aquifers follows closely the pattern for the Test wells and the Waiehu deep monitor well in the Iao Aquifer (see our Exhibit A). Interpretation of levels over a one or two year period is not prudent practice, and is misleading.

Appendix B, MDWS Comments to Petition

a) *FOF*

Reduced pumping in Waiehu Heights and Mokuhau well fields is compensated by extra pumping from Shaft 33.

Comment

With extra pumpage from Shaft 33, isn't there a danger that this source will eventually suffer from salt water encroachment?

b) *FOF*

The MDWS has still not resolved the Central Maui Joint Venture Agreement problem.

Comment
Resolution of this problem is essential to the long term solution of the water supply planning for the Central Maui area. How does the DWS plan to go about resolving this issue since essentially all of the participation groups have disbanded?

Appendix D, Written Testimony from January 9, 2002 Public Hearing
FOF
40 for designation.
7 against designation, principally Maui County Agencies, and including two members of the MBWS who testified as individuals.
Comment
There was overwhelming support from the public for designation of the Iao and Waihee Aquifers.

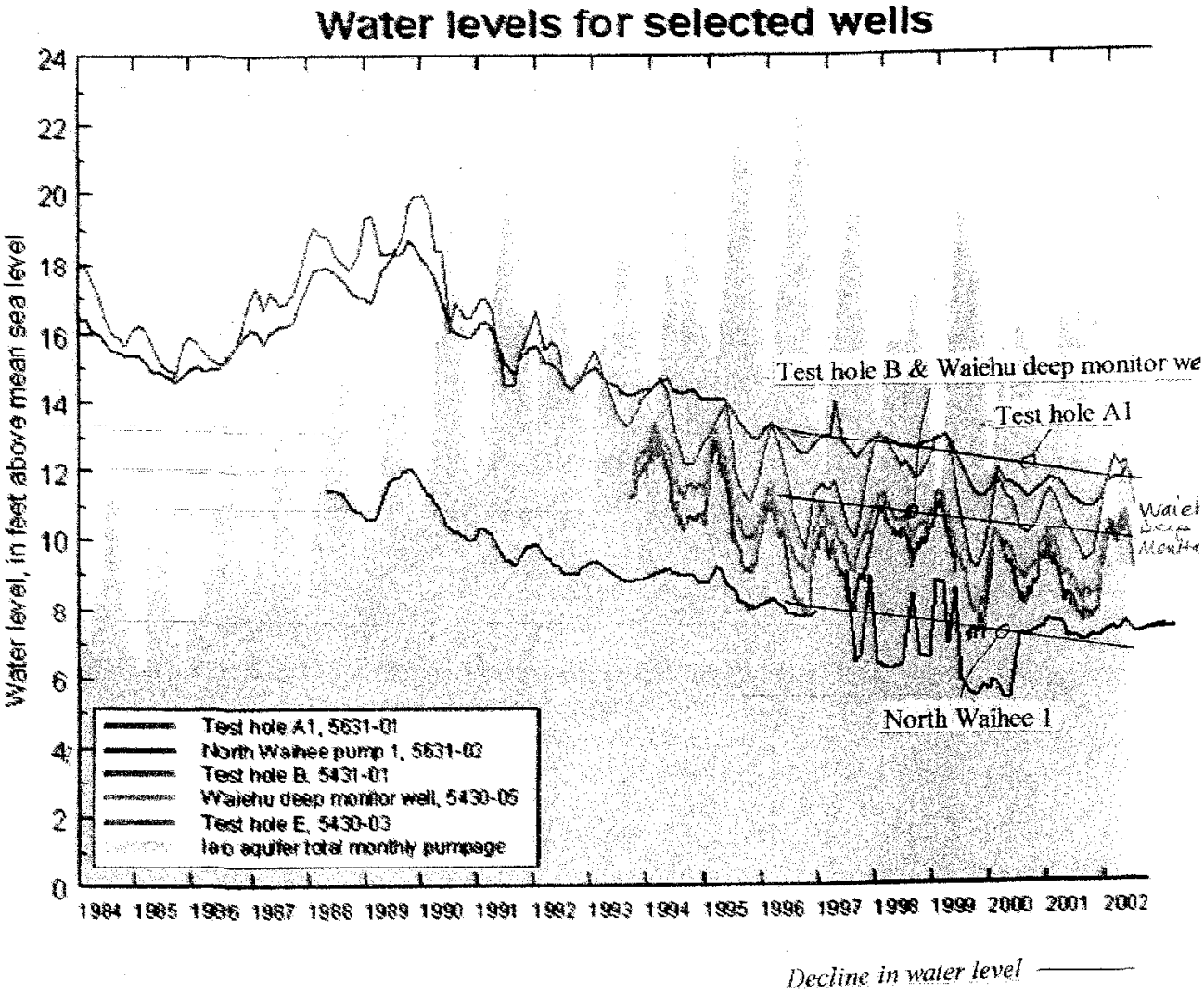
If you have any questions please contact us.

Sincerely,

James V. Williamson

James V. Williamson, P. E.
Vice President

EXHIBIT A


Water levels for selected wells
Water level, in feet above mean sea level
24
22
20
18
16
14
12
10
8
6
4
2
0
1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
Test hole A1, 5631-01
North Waihee pump 1, 5631-02
Test hole B, 5431-01
Waiehu deep monitor well, 5430-05
Test hole E, 5430-03
Iao aquifer total monthly pumpage
Test hole B & Waiehu deep monitor we
Test hole A1
North Waihee 1
Decline in water level

RM

RECEIVED

02 NOV 6 AM : 46

COMMISSION ON WATER
RESOURCE MANAGEMENT

William Meyer
6750 Hawaii Kai Dr. #501
Honolulu, Hawaii 96825

November 3, 20002

Mr. Gilbert Coloma-Agaran, Director
State of Hawaii, Commission on Water Resources Management
P. O. Box 621, Honolulu, Hi 96813

RE: Designation of the Iao Aquifer

Dear Mr. Coloma-Agaran,

The purpose of this letter is to inform you that I believe that the Iao Aquifer System on Maui should be designated in order to protect the public's interest in the aquifer. I have enclosed a sixteen page written statement in support of this opinion.

Sincerely,

William Meyer

William Meyer

Written statement of William Meyer[1]

October 26, 2002

For Consideration by the Commission on Water Resources Management in Designating the Iao and Waihee Aquifer Systems, State Aquifer Code 60102 and 6010, on the island of Maui as Ground-Water Management Areas

GENERAL COMMENTS

Based on the adoption of the 1990 Water Resources Protection Plan (WRPP), the Commission on Water Resources Management has established a value for the sustainable yield of the Iao aquifer equal to 20 million gallons per day (mgd). On the other hand, an evaluation of: 1) the hydrologic data that was presented in the WRPP for establishment of sustainable yield, 2) field data collected since approval of the WRPP over ten years ago, 3) a technical evaluation of the methodology used in the WRPP to establish sustainable yields for the state's aquifers by the United States Geological Survey (USGS), 4) a large range in values for recharge to the Iao aquifer determined by successive researchers, including the author of the WRPP, and finally, 5) the need to incorporate scientific uncertainty into protection of the state's water resources as mandated by the Hawaii Supreme, collectively support a value for sustainable yield that is less than 20 mgd.

Although all of the major well fields currently active in the Iao aquifer were in place when the sustainable yield of the aquifer was established by the Commission, the USGS has recently (2000) published a report (WRI-00-4223) which concludes that 20 mgd is not available from this infrastructure. The Commission staff has agreed with this conclusion, but dismisses the problem by claiming that optimization of well location is required to realize the full sustainable yield. Although, optimization would increase the yield from the aquifer, there is no factual scientific study to support the staff's conclusion that optimization will allow 20 mgd to be developed. The staff also readily admits that

[1] My testimony is based on my background and experience. I received a Bachelor of Arts Degree in Geology from Arizona State University in 1962 ans a Master of Science Degree in Hydrology from the University of Arizona in 1965. From 1965 to 1999, I worked in various capacities as a hydrologist for the United States Geological Survey. From October 1986 through June 1999, I served as the head of the United States Geological Survey's District Office in Hawaii. Since my retirement in 1999, I have continued to remain active in selected hydrologic issues in Hawaii and have published two articles on hydrology during this time. The details of my background and a list of publications are included in my curriculum vitae, which is attached as Exhibit A.

the required optimal location of wells is not known at the present time, but even so, they continue to recommend that the sustainable yield of the Iao aquifer be maintained at 20 mgd. Despite this recommendation, the staff also readily admits that 1) "*if the full sustainable yield were withdrawn from too few sources, localized effects would reduce the length of time those sources can be used* " and 2) that this is the current situation in the Iao Aquifer. Given these admissions, it is mandatory that the Commission designate the aquifer in order to protect the long-term public interest in the resource. See HRS 174C-41(a) (Designation is mandatory "When it can be reasonably determined . . . that the water resources in an area may be threatened by existing or proposed withdrawals or diversions of water").

The Maui County Department of Water Supply (DWS) is withdrawing almost all of the water from the Iao aquifer. The DWS's rate of pumping steadily increased during the early and middle 1990s until it reached and slightly exceeded 20 mgd in 1995 and 1996. In response to this rate of withdrawal, water levels declined below elevations necessary to protect the long-term integrity of the aquifer. Designation hearings conducted by the Commission at the recommendation of its staff in 1996-97 resulted in the Commission allowing the 20 mgd sustainable yield value to stand, while the aquifer remained undesignated. The Commission also required the DWS to reduce its rate of withdrawal to a value below 20 mgd. Although withdrawal has been below sustainable yield since 1997, hydrologic conditions have **not** improved and, instead, have worsened.

Sustainable yield is defined in the Water Code as the "*the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the commission.*" It is necessary to optimally locate wells in order to obtain the maximum rate of withdrawal from an aquifer, and the Commission's staff states that sustainable yield values provided in the WRPP for the state's aquifers are based on an optimal location of wells. However, this position is not internally consistent with the Commission's approval process for well installation. For instance, in an area that has not been designated as a ground water management area, it is the proposed well owner who selects the location for the well while the Commission requires only that the proposed use of the water is reasonable, after which, they require a limited pump test at the proposed well site to establish that the desired amount of water is available. In order to establish that sustainable yield is not being exceeded, the approval process also considers the existing rate of withdrawal from the aquifer relative to the WRPP sustainable yield value for the aquifer. No routine discussion or consideration is given to optimizing well location, and the Commission has never specified or established optimal well locations for any of the state's aquifers.

The WRPP management scheme employed by the Commission has glaring flaws. First, it relies on a system that determines sustainable yield based on an optimized distribution of wells, but fails to specify or require this distribution. Therefore, the Commission's own management scheme allows the rate of ground water withdrawal to approach or reach the WRPP value of sustainable yield even though the well distribution is not optimized. In reality, this scheme is a trial and error process that will eventually create unacceptable hydrologic conditions identical to those now existing in and threatening the Iao Aquifer,

in many if not all of Hawaii's aquifers. This management system, therefore, fails to meet the Commission's mandate for promoting maximum beneficial use of the resource while at the same time protecting the resource for future generations.

As demonstrated by conditions in the Iao aquifer, development of an aquifer to its theoretical maximum potential when wells are not optimally located will result in saltwater intrusion into some or all of the existing infrastructure. The Commission has faced this problem in the aquifers of the Pearl Harbor area on Oahu, and has opted to set sustainable yield values to ones that presumably protect existing infrastructure rather than maximize development with optimal well location. Unfortunately, this Commission has refused to consider this approach for the Iao aquifer. The Code also addresses this situation with some of the criteria it sets for aquifer designation. Criteria 4 and 5 are both concerned with existing infrastructure. See HRS 174C-44.

WATER LEVELS, CHLORIDE CONTENT OF PUMPED WATER, AND MOVEMENT OF THE TRANSITION ZONE

Water levels are the single most important entity in understanding ground water occurrence in an aquifer and for evaluating the long-term health of an aquifer that is being pumped. The importance of water levels is recognized in the Water Code where they are one of the eight criteria to be considered by the Commission for designation of an aquifer. See HRS 174C-44(3). Their importance is also recognized in the WRPP, where water levels under pumping conditions are used to establish a value for sustainable yield.

The second most important entity for evaluating the health of an aquifer being pumped is the chloride content of the pumped water. The importance of chloride content of pumped water is also recognized in the Water Code, and it is also one of the eight criteria established by the Code for designation of an aquifer. See HRS 174C-44(5).

Third in order importance, would be the position of the transition zone between fresh water and seawater. The upward movement of the transition zone in response to declining water levels is a phenomenon known as upconing. Upconing is another criteria established by the Water Code for designation of an aquifer. See HRS 174C-44(4). **Water levels, chloride content, and the movement of the transition zone are all susceptible to measurement in the field, and as such are not subject to differences of opinion.**

Much of the discussion presented by the Commission staff in its September 17, 2002 draft Findings of Fact (FOF) on the Iao and Waihee Aquifer Systems is concerned with the above three criterion, but the FOF fails to discuss the hydrologic situation presented by this information in its entirety and in some cases, the discussion obscures the actual situation in the field causing conditions to appear better than they are. Measurement of these parameters since the late 1980's has shown that:

1) Water levels in the Iao aquifer began to fall in all observation wells between 1989 and 1990 in response to increasing rates of ground water withdrawal from the aquifer. Ground water withdrawal peaked at 20.5 mgd in 1996 after which it has been gradually reduced, with the present 12-month moving average equal to 16.01 mgd through June 2002. Despite this reduction, water levels continued to decline through most of the decade of the 1990s. The decline in water levels has recently slowed or ceased altogether, largely due to the decrease in the rate of ground water withdrawal since 1996, but they are presently, and have been for a number of years, below values that will preclude saltwater intrusion into most major well fields (table 1) and below values established in the WRPP that are stated to be necessary to preserve the intergerity (integrity?) of the ground water resource (table 2). Unfortunately, none of this is discussed in the Commissions staff's 9/17/02 FOF, which, in turn, means that the staff's FOF presents incomplete information and thereby limits the knowledge available to the Commission on this subject. **The conditions described above clearly meet criteria (3) of the Water Code for designation of the aquifer.**

2) Chloride content rose significantly above the EPA guideline of 250 milligrams per liter (mg/l) in one well (Mokuhau no. 2), causing pumpage to cease altogether, and has been as high as 250 mgl in three other wells (Mokuhau 1 and 3, 5330-09, 11 and Waiehu Heights 1, 5403-01) causing the rate of withdrawal to be reduced in these wells. All of this occurred with the rate of ground water withdrawal below 20 mgd. **These conditions clearly meet criteria (5) of the water Code for designation of the aquifer.**

3) Measurement of the position of the transition zone was initiated in the Waiehu Deep Monitor well in 1985. These measurements have indicated a continual rise in the transition zone. All of the wells in the basal part of the Iao aquifer are experiencing varying degrees of saltwater intrusion as a result of this rise and current water levels at all of the well fields in the basal part of the aquifer indicate that the degree of intrusion will only worsen over time, causing the chloride content of pumped water from these fields to ultimately become unacceptable for domestic purposes. **These conditions clearly meet criteria (4) of the Water Code for designation of the Iao aquifer.**

THE TIME LAG BETWEEN WATER LEVEL DECLINES AND THE RISE OF THE TRANSITION ZONE

The introduction of pumpage causes ground water levels to decline, but, as long as the aquifer is not being over-pumped, the decline will eventually cease and water levels will stabilize at new but lower elevations than those for non-pumping conditions. There is a considerable time lag between a reduction in water levels from pumpage and the resultant rise in the transition zone. This lag, which is occurring at the present time in the Iao aquifer, can be on the order of years, but because of the laws of physics, the transition zone must ultimately rise to be in balance with the lower position of the water table

caused by pumping. The equation that describes this balance is known as the Ghyben-Herzberg Equation.

The Ghyben-Herzberg principle or equation can be used to predict the approximate position of the midpoint of the transition zone for stabilized water levels under pre-pumping conditions and for stabilized water levels under pumping conditions. The equation states that for every one-foot that the water table is above sea level, the midpoint of the transition zone is 40 feet below sea level. Thus, if water levels for pumping conditions have stabilized at 10 ft above sea level, the midpoint of the transition zone will ultimately be 400 ft below sea level. **Use of the Ghyben-Herzberg equation for current water levels in the Iao aquifer indicate that most of the Maui County Department of Water Supply well fields will ultimately become too salty for domestic use.** This fact is completely ignored and to some extent is misunderstood by staff's 9/17/2002 discussion of water levels in the Iao aquifer.

Although the staff agrees that water levels under pumping conditions are governed by the Ghyben-Herzberg principle, they dismiss the importance of current water levels by stating that "*water levels in both pumping and observation wells (*under pumping conditions*) will recover rapidly (*when pumpage is terminated*) and are not indicative of the overall condition of the aquifer.*" **Nothing could be further from the truth.** Water levels under non-pumping conditions are of limited importance to well fields. On the contrary, water levels under pumping conditions obviously are critical. Few are concerned with saltwater intrusion into non-pumping wells. The WRPP (**which was prepared by Mink and Yuen**) recognizes the importance of water levels under pumping conditions wherein it establishes the equilibrium water level, which as stated above, is the elevation of the unconfined water table under pumping conditions that will preserve the integrity of the ground water resource. Obviously, by definition, if water levels fall below this elevation, the integrity of the aquifer will not be preserved. This is the present situation in the Iao aquifer. See HRS 174C-44(3).

Despite his current stance that pumping water levels are not significant and, despite the contradiction of this stance with his writing in the WRPP, John Mink wrote in a report titled "The Waiehu Aquifer: An Evaluation" that " *To protect the integrity of all wells now drilled between Waikapu and Waihee, the regional head (water level) should not be permitted to fall below 12 ft*". Mink goes on to state that "*if the regional head decayed to 12 ft (*with the wells pumping and a drawdown of 5 ft below the regional water level at the well*), the theoretical interface would be [(12-5)*40] 280 ft below sea level*". Mink continues his discussion stating that "*Because the well bottom is at –150 ft, only 130 ft of lens would lie below. If the zone of transition is thick, as could be expected where 5 mgd pumps are used, brackish water might reach to the well bottom*". This analysis is identical to the one used by the USGS to indicate that water levels are too low in the Iao aquifer and is consistent with the concept of an equilibrium head presented by Mink in the WRPP. However, both Mink and the Commission staff now refute such an analysis, even though neither party provides a sound scientific basis for their stance.

The staff, in its September 17, 2002 FOF argues that the midpoint of the transition zone is still much lower than that predicted by current water levels in the Iao aquifer under pumping conditions, and that this indicates that the aquifer is not being over pumped. This argument demonstrates a complete lack of understanding of the lag time between the decline in water levels and the upward movement of the transition zone. The lag time assures that the position of midpoint will be lower than that predicted by a decline in water levels for a considerable time after the decline occurs. The staff's argument that the aquifer is not being over pumped in this case also demonstrates a complete failure to realize that as long as pumping continues, water levels will not improve. The staff's combined misunderstanding of the lag time between water level declines and the movement of the transition zone, and of the importance of WRPP equilibrium water levels for assuring aquifer integrity, is highly significant, and causes them to ignore or overlook the existing situation in the Iao aquifer, a fact which, in turn, threatens the ability of the Commission to fulfill its mandate to protect water resources for future generations.

The FOF dismisses by omission the fact that lag time exists at all, even though the process is well understood and easily explained by basic laws of hydrology. Whereas the decline in water levels is a pressure response to ground water withdrawal at the well site that spreads rapidly in all directions away from the well, movement of the transition zone upward in response to this decline in water level involves the upward movement of individual salt particles. This latter movement takes place at a much slower pace than the change in pressure within the aquifer that induces the movement of the salt. The rate of movement of a water or salt particle is described by a fundamental equation in quantitative hydrology known as Darcy's law. This law is universally accepted in hydrology and, among other things, forms the basis for the RAM. The Ghyben-Herzberg equation is also invoked in development of the RAM.

Use of Darcy's law for field conditions in the neighborhood of the Waiehu deep monitor well indicates that the rate of movement of a salt particle upward in response to a 1 ft change in water levels would be on the order of about 5 ft per year for a value of vertical permeability equal to 1 ft per day. The actual movement that has been observed has been, on average, about 8 ft per year. Remembering that a 1-ft decline in water levels corresponds to a 40 ft rise in the transition zone, it is easy to understand that it will take about 8 years for the transition zone to complete its movement if the upward rate of movement of the salt particle is 5 ft per year and about 5 years for an upward movement equal to 8 ft per year. On the other hand, the time required for the 1 ft decline in water levels would have taken only days or months depending on the rate of ground water withdrawal. There are other considerations that also result in increasing the lag time between the decline in water levels at the water table and the movement of the transition zone, but because the lag time is only increased, there is no need to discuss these other considerations. If the Commission or staff would like more information on these other considerations, I would be happy to provide them.

SUSTAINABLE YIELD AND SCIENTIFIC UNCERTAINTY

The sustainable yield value of 20 mgd for the Iao aquifer has come under severe criticism based on: 1) actual hydrologic conditions in the Iao aquifer since 1996 to the present time, 2) the failure of the Commission to recognize that field conditions indicate that water levels are below equilibrium water levels as determined by the RAM, which in turn, indicates that the sustainable yield is less than 20 mgd, 3) limitations of the WRPP methodology (the RAM) to determine sustainable yield, and 4) the range in values for ground water recharge to the Iao aquifer that have been estimated by a succession of hydrologic studies and the resultant range in sustainable yield for the aquifer that these values result in.

The Hawaii Supreme Court, in its remanded Waiahole decision, indicated that the Commission should apply the "Precautionary Principle" in its management of the state's water resources and incorporate "scientific uncertainty" into protection of the resource when uncertainty exists. Despite this mandate and, despite the existing questions discussed above, the Commission staff still maintains that the sustainable yield of the aquifer is 20 mgd, and has made no effort whatsoever to decrease the sustainable yield in order to incorporate known scientific uncertainty into that value. The following discussion demonstrates the degree of scientific uncertainty associated with the 20 mgd sustainable yield value of the Iao aquifer.

Actual Hydrologic Conditions

Water levels in the Iao aquifer are presently below values that will preclude saltwater intrusion into most major well fields and are below values established in the WRPP that are stated as necessary to preserve the intergerity of the ground water resource. In its simplest sense, management of an aquifer requires maintaining ground water withdrawal at each well in the aquifer at a rate that will preclude saltwater intrusion into any of the wells. Withdrawal of water causes ground water levels to decline and intrusion occurs when water levels decline below the elevation necessary to preclude the rise of the freshwater-saltwater transition zone into a well. The importance of water levels in preventing saltwater intrusion is recognized in the Water Code, where it requires the Commission to consider excessively declining water levels as one of the eight criteria for designation of an aquifer. See HRS 174C-44. Water levels of most importance in this regard are water levels in the vicinity of pumping wells.

Water levels in Iao aquifer over the last one-and-a-half years along with the intrusion head or water level are shown below in table 1.

Table 1. Water levels in the Iao Aquifer, January 2001 to July 2002.

Well	1/09/01	4/03/01	7/17/01	10/16/01	7/2/02	**Intrusion head**
N. Waihee	7.55	7.48	7.02	7.07	7.18	**7.0**
A1	11.65	11.41	11.01 (7/3/01)	10.85	11.5	
Waiehu Montior	9.85 (12/15/00)	9.19 (3/15/01)	8.75 (6/15/01)	8.37 (9/15/01)	9.02	
Test Hole B	9.41 (12/15/00)	8.85 (3/15/01)	8.11 (6/15/01)	7.73 (9/15/01)	9.58	
Test Hole E	11.3	10.47	9.75 (7/03/01)	9.43	10.82	
Mokuhau pump 2	7.43		4.22 (7/03/01)	6.61	8.11	**10.6**
Shaft 33	8.87	8.49	7.97	7.83	8.71	**11.4**
Waihee	<9.85	<9.19	<8.75	<8.37	< 9.02	**8.9**
Waiehu Hts.	<9.41	<8.85	<8.11	<7.73	< 9.58	**12.8**

The Failure of the Commission to Recognize Water Levels Are Below Equilibrium Water Levels as Determined by the RAM.

The importance of water levels in maintaining the health of an aquifer is also demonstrated by the fact that the sustainable yields of the state's aquifers were established by first determining a minimum value for water levels in each aquifer. **As stated in the 1990 Water Resources Protection Plan, "the value (of sustainable yield) depends on the head that will preserve the intergerity(integrity?) of the ground water resource..."** Head is defined in the WRPP as "the elevation of the unconfined water table above sea level." **The minimum value established for each aquifer in the WRPP is the equilibrium head for that aquifer.**

When ground water pumpage occurs, water levels decline. But, as long as the aquifer is not over pumped, water levels will stabilize at an elevation lower than the pre-pumping conditions. **The altitude at which the water table stabilizes after pumpage is initiated is referred to in the WRPP as the equilibrium head. If the water level drops below the equilibrium head for pumpage rates less than or equal to sustainable yield, then, by definition, the sustainable yield is less than the value established for the aquifer.**

As shown by table 2, the elevation of the water table is below the equilibrium head at all of the major well fields in the basal part of the Iao aquifer. Water levels fell

below predicted equilibrium water levels as early as 1992 and, as of July 2002, water levels ranged from 3.5 to 6.6 below predicted equilibrium water levels. Therefore, the current sustainable yield of 20 mgd is not only wrong, but the designation of the Iao aquifer is mandatory because it can be reasonably determined that the water resources in this area are threatened by existing or proposed withdrawals of water.

Table 2. Predicted equilibrium head (in altitude above sea level) and observed water levels at well fields in the basal part of the Iao aquifer.

(1) Well Field	(2) Equilibrium head (ft)	(3) Average measured water level (ft)	(4) year	(5) **Decline of water levels below the Equilibrium Head in ft** (2)-(3)
Shaft 33	14	10	1996	**-4**
		10.5	1998	**-3.5**
		8.5	March 01	**-5.5**
		8.71	July 02	**-5.3**
Mokuhau	14	10.5	1998	**-3.5**
		7.4	March 01	**-6.6**
		8.11	July 02	**-5.9**
Waihee	15	<9.04	2001	**-6.0**
		<9.02	July 02	**-6.0**
Waiehu Heights	15	<8.5	2001	**-6.5**
		<9.58	July 02	**-5.4**

Technical Criticism of the WRPP Methodology Used for Determining Sustainable Yield.

The analytic limitations of the Robust Analytic Model which is used by the Commission to establish sustainable yield was investigated by the USGS and their results are published in USGS Water Resources Investigative Report WRI-00-4244. This report concludes that **inherent limitations in the RAM model will cause it to under-predict water level declines in Hawaii's aquifers, with the greatest error in prediction occurring at the sites of ground water withdrawal. This limitation will cause the RAM model to over-predict sustainable yield and will leave pumping locations vulnerable to saltwater intrusion. These conclusions describe the existing situation in the Iao Aquifer at this time and warrant designation of the Iao aquifer as a ground water management area.** The limitations of the RAM model result from its inability to represent spatial variables that actually control the decline in water levels in

an aquifer in response to ground water pumping. These variables include spatially varying hydraulic properties of an aquifer and the spatial configuration of wells. The USGS report establishes that the error inherent in the RAM model is exacerbated for hydrologic settings consisting of a basal aquifer overlain by a "caprock", which is the setting for the Iao Aquifer.

As indicated by the 9/17/2002 FOF, John Mink, author of the RAM, has responded to this criticism by stating that the USGS critique suffers from misunderstanding of storage head, ignoring salinity-depth curves, and willfully ignoring ordinary field conditions. These statements are without merit. They also conflict with statements made in published reports by Mink, including the WRPP itself. Whereas the RAM has never undergone independent technical review prior to the USGS report, the latter report has undergone extensive peer review and its conclusions with regard to the RAM are considered to be valid by the reviewers. Far from ignoring field conditions, the USGS has maintained a cooperative program with the Commission and the Maui County Department of Water Supply to collect field data in the Iao and Waihee aquifers. This data is readily available to the public at large and has been the basic source of hydrologic information used by all parties involved in the current dispute over sustainable yield of the two aquifers, including the Commission. The USGS has published this information in reports and on its WEB-site, which is updated quarterly.

The Range in Values for Ground Water Recharge to the Iao Aquifer and The Resultant Range in Sustainable Yield

The value for sustainable yield, as determined by the Commission, is directly related to the value estimated for ground water recharge. As shown in table 3 there is a wide range in published values for recharge to the aquifer and resultant values in sustainable yield. Most of the latter values are less than 20 mgd.

Although the WRPP states that the sustainable yield of the Iao aquifer is 20 mgd, there is no basis for this value in the WRPP itself. Given the values for ground water recharge and initial head for the aquifer provided in the WRPP, the sustainable yield of the aquifer would actually be 9.6 mgd (table 3). The sustainable yield of 20 mgd given in the WRPP actually exceeds the WRPP value stated for recharge to the aquifer, which is physically impossible. The Commission, although aware of these facts, continues to maintain a value of 20 mgd for the sustainable yield of the aquifer. I would also like to point out to the Commission, that the sustainable yield value of 20 mgd for the Iao aquifer is not supported by hydrologic data published in any single document, including those of the Commission's.

Table 3, Sustainable yield of the Iao aquifer based on published values for ground water recharge. Sustainable yield is determined based on the WRPP methodology used by the CWRM.

source	year	ground-water recharge (mgd)	**sustainable yield (mgd)**
Caskey	1968	1.6 -32.3	**1 – 20.7**
DLNR	1970	60	**38.4**
USGS	1970	35	**22.4**
Mink	1977	20 –30	**12.8 – 19.2**
1990 WRPP	1990	15	**9.6**[1]
Mink	1995	31.6	**20.2**
Shade	1997	29	**18.6**
Mink	2001	20 - 23	**12.8 – 14.7**

1. The value of 9.6 mgd is obtained by using the value for recharge (15 mgd) and initial head (25 ft) stated for the Iao aquifer in the WRPP.

References:

1) Caskey, M.C., 1968, The Recharge of the Waikapu Aquifer, Maui: M.S. thesis, Univ. Hawaii.

2) State of Hawaii, 1970, Water for Kihei-Makena: Hawaii, Dept. Land and Natural Resources, Report R-38.

3) Yamanaga, G., and Huxel, C.J., 1970, Preliminary report on the water resources of the Wailuku area, Maui: Hawaii Dept. of Land and Natural Resources, Circular C-61.

4) Mink, John F., 1977, The Waiehu aquifer: An Evaluation.

5) Yuen, George A. L., and Associates, Inc., 1990: Water Resources Protection Plan, Volumes I and II: Commission on water Resources Management, Hawaii Dept. of Land and Natural Resources.

6) Mink, John F. 1995, Sustainable Yields, Maui and Molokai, Letter to Rae M. Loui, Deputy Director CWRM.

7) Shade, P.J., 1997, USGS Water-Resources Investigations Report 97-4244.

8) Mink, John F., 2001, Iao aquifer system recovery test, Mink and Yuen, Inc. report to Department of Water Supply, County of Maui, Hawaii.

The September 17, 2002 FOF provides another water budget for the Iao aquifer, but this budget does little or nothing to resolve the differences in the budgets shown above in

table 3. The staff's budget analysis starts off with an assumption that the 1990 WRPP value for rainfall is reasonable. This is hardly a scientific statement. The analysis then suggest that fog drip is probably a significant contributor to the Iao Aquifer System's water resources but fails to provide an estimate of the amount of water contributed by this process. The basis for estimating other parameters in the water budget is also technically weak, and as a result, the final water budget suggested by the staff has little merit to recommend it to the Commission. If taken at face value, the budget without fog drip, would indicate that recharge to the aquifer system under natural conditions is only 0.5 mgd which is highly unreasonable. This value for recharge would result in a value for sustainable yield in the absence of fog drip equal to approximately 0.4 mgd.

For all of the reasons provided above, it can be reasonably determined that the water resources in the Iao aquifer may be threatened and the Commission should designate this aquifer system as a ground water management area.

EXHIBIT A

Curriculum vitae

William Meyer
6750 Hawaii Kai Dr. #501
Honolulu, Hawaii 96825
395-7152

EDUCATION

Arizona State University, Tempe, Arizona ; Bachelor of Science, Geology, June 1962

University of Arizona, Tucson, Arizona; Master of Science, Hydrology, June 1965

EXPERIENCE

July 1999 to present – Retired from the United States Geological Survey

October 1986 to July 1999- District Chief, United States Geological Survey Hawaii District

Responsible for implementing and administering United States Geological Survey programs in hydrologic research, investigations, and data collection in the State of Hawaii, the territories of American Samoa and Guam, the Republic of the Marshall Islands, the Republic of Palau, and the Federated States of Micronesia.

October 1982 to October 1986- Assistant District Chief, Hydrologic Investigations and Research, Pacific Northwest District, United States Geological Survey.

Responsible for implementing and administering hydrologic research and investigations conducted by the United States Geological Survey in the States of Washington and Oregon.

September 1978 to October 1982- Assistant District Chief, Hydrologic Investigations, Washington District, United States Geological Survey.

Responsible for implementing and administering hydrologic investigations conducted by the United States Geological Survey in the State of Washington.

EXPERIENCE (cont.)

September 1973 to September 1978- Assistant District Chief, Hydrologic Investigations, Indiana District, United States Geological Survey

Responsible for implementing and administering hydrologic investigations conducted by the United States Geological Survey in the State of Indiana.

June 1969 to September 1973- Research Hydrologist, Prescott Research Office of the United State Geological Survey

Conducted research into the application of remote sensing to hydrology.

June 1965 to September 1969- Research Hydrologist, Phoenix Research Office of the United States Geological Survey

Conducted research into the application of remote sensing to hydrology.

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